

WHAT IS CLAIMED IS:

1. A hydraulic drive apparatus for driving and rotating a drive rotary member in accordance with an operation position input from operation position inputting means, the apparatus comprising:

a drive rotary member driven and rotated by hydraulic pressure;

working oil supplying means for supplying working oil to drive and rotate the drive rotary member;

rotation control means for controlling a quantity of the working oil supplied from the working oil supplying means to the drive rotary member so that the drive rotary member is driven and rotated as desired, the rotation control means including:

operation position inputting means for inputting an operation position;

operation-position signal outputting means for generating and outputting an operation position signal depending on the operation position input by the operation position inputting means;

drive signal outputting means for computing and converting the operation position signal output from the operation-position signal outputting means into a drive signal to be output therefrom;

an electric motor driven and rotated at a speed and a
quantity of rotation depending on the drive signal output from
the drive signal outputting means; and

working oil control means for controlling a quantity
5 of the working oil supplied from the working oil supplying means
to the drive rotary member so that the drive rotary member is driven
and rotated depending on rotation of the electric motor;

drive oil pressure detecting means for detecting a pressure
of the working oil for driving and rotating the drive rotary member,
10 and generating and outputting a drive oil pressure signal
depending on the pressure thus detected;

supplying oil pressure detect means for detecting a
pressure of the working oil supplied from the working oil supplying
means to the working oil control means, and generating and
15 outputting a supplying-oil pressure signal depending on the
pressure thus detected;

a main relief valve for regulating a pressure of the working
oil supplied from the working oil supplying means to the working
oil control means to be equal to or lower than a set pressure;

20 an electromagnetic relief valve for varying the set
pressure of the main relief valve by varying a set pressure
thereof; and

oil pressure control means for receiving the supplying-

oil pressure signal output from the supplying oil detect means and the drive oil pressure signal output from the drive oil pressure detecting means, and outputting a current to the electromagnetic relief valve to vary the set pressure of the electromagnetic relief valve and thus the set pressure of the main relief valve, thereby controlling the pressure of the working oil supplied from the working oil supplying means to be higher, by a predetermined pressure, than the pressure of the working oil for driving and rotating the drive rotary member.

2. A hydraulic drive apparatus according to claim 1, further comprising:

supplying oil quantity control means for controlling a quantity of the working oil that the working oil supplying means supplies; and

supplying oil quantity signal outputting means for receiving the operation position signal output from the operation-position signal outputting means, generating a supplying oil quantity signal from the input operation position signal, and outputting the supplying oil quantity signal to the supplying oil quantity control means, thereby controlling the quantity of the working oil supplied to the supplying oil quantity control means by the working oil supplying means.

3. A hydraulic drive apparatus according to claim 1,

Sub C1 } wherein the drive oil pressure detecting means includes a pressure gauge for detecting the pressure of the working oil supplied from the working oil control means to the drive rotary member, and another pressure gauge for detecting the pressure of the working
5 oil supplied from the drive rotary member to the working oil control means.

10 4. A hydraulic drive apparatus according to claim 1, wherein when the pressure of the working oil detected by the drive oil pressure detecting means is equal to or higher than a predetermined pressure, the oil pressure control means feeds current of a predetermined value to the electromagnetic relief valve.

Sub C1 } 15 5. A hydraulic drive apparatus according to claim 4, further comprising:

20 a check valve for preventing a reverse flow of the working oil when the working oil whose pressure is regulated to be equal to or lower than the set pressure by the main relief valve is supplied from the working oil supplying means to the working oil control means.

20 6. A hydraulic drive apparatus according to claim 1, further comprising:

an additional drive rotary member driven by hydraulic pressure;

additional rotation control means including:

an additional electric motor driven at a speed and a quantity of rotation depending on the drive signal output from the drive signal outputting means, and

5 additional working oil control means for receiving from the working oil supplying means the working oil equal in pressure to the working oil supplied from the working oil supplying means to the working oil control means, and controlling a quantity of the working oil supplied from the working oil supplying means
10 to the additional drive rotary member so that the additional drive rotary member is driven and rotated depending on rotation of the additional electric motor; and

additional drive oil pressure detecting means for detecting a pressure of the working oil for driving and rotating
15 the additional drive rotary member, and generating and outputting a drive oil pressure signal depending on the pressure thus detected;

wherein the oil pressure control means receives the supplying-oil pressure signal output from the supplying oil
20 pressure detect means, the drive oil pressure signal output from the drive oil pressure detecting means, and the drive oil pressure signal output from the additional drive oil pressure detecting means, and outputs the current to the electromagnetic relief valve

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to vary the set pressure of the electromagnetic relief valve and thus the set pressure of the main relief valve, thereby controlling the pressure of the working oil supplied from the working oil supplying means to be higher, by the predetermined pressure, than
5 a higher one of the pressure of the working oil for driving and rotating the drive rotary member and the pressure of the working oil for driving and rotating the additional drive rotary member.

7. A hydraulic drive apparatus according to claim 6, wherein the additional rotation control means includes:

10 additional operation position inputting means for inputting an operation position

additional operation-position signal outputting means for generating and outputting an operation position signal depending on the operation position input to the additional operation

15 position inputting means; and

additional drive signal outputting means for computing and converting the operation position signal output from the additional operation-position signal outputting means into a drive signal to be output therefrom;

20 wherein the additional electric motor is driven and rotated at a speed and a quantity of rotation depending on the drive signal output from the additional drive signal outputting means.

8. A hydraulic drive apparatus according to claim 6,

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further comprising:

supplying oil quantity control means for controlling a quantity of the working oil that the working oil supplying means supplies; and

5 supplying oil quantity signal outputting means for receiving the operation position signal output from the operation-position signal outputting means, and the operation position signal output from the additional operation-position signal outputting means, generating the supplying oil quantity
10 signal from the thus input two operation position signals, and outputting the supplying oil quantity signal to the supplying oil quantity control means, thereby allowing the supplying oil quantity control means to control the quantity of the working oil that the working oil supplying means supplies.

15 9. A hydraulic drive apparatus comprising:

a hydraulic pump for supplying working oil;

a first hydraulic motor supplied with the working oil from the hydraulic pump, and driven and rotated by the supplied working oil;

20 a first operation unit for driving and rotating the first hydraulic motor, the first operation unit including:

first operation position input means for receiving an operation position, generating an operation position signal

depending on the operation position, and outputting the operation position signal;

drive signal outputting means for receiving the operation position signal, computing and converting the operation position signal into a drive signal, and outputting the drive signal;

an electric motor that receives the drive signal and that is driven and rotated at a rotational speed depending on the drive signal; and

a first control valve, through which the working oil supplied from the hydraulic pump to the first hydraulic motor flows, for controlling a quantity of the working oil flowing therethrough depending on the rotational speeds of the electric motor and the first hydraulic motor, thereby controlling the quantity of the working oil supplied from the hydraulic pump to the first hydraulic motor, wherein the first operation unit drives and rotates the first hydraulic motor depending on the operation position that is input to the first operation position input means;

a second hydraulic motor supplied with the working oil from the hydraulic pump and driven and rotated by the supplied working oil;

a second operation unit for driving and rotating the second hydraulic motor, the second operation unit including:

working oil is supplied from the hydraulic pump and through which the working oil flows therethrough, for adjusting the pressure of the working oil supplied from the hydraulic pump to the first control valve to be equal to or lower than a set pressure;

5 second working oil pressure adjusting means, through which the working oil supplied from the hydraulic pump to the second control valve flows therethrough, for adjusting the pressure of the working oil supplied from the hydraulic pump to the first control valve to be equal to or lower than a set pressure ; and

10 pressure adjust signal outputting means, to which the operation position signal, the supplying-oil pressure signal and the drive oil pressure signal are input, for judging, depending on the operation position signal thus input, whether the first operation unit drives and rotates the first hydraulic
15 motor or stops the rotation of the first hydraulic motor, wherein when the first operation unit drives and rotates the first hydraulic motor, the pressure adjust signal outputting means computes a pressure of the working oil necessary for driving and rotating the first hydraulic motor using the input supplying-
20 oil pressure signal and drive oil pressure signal, and generates a pressure control signal for allowing the second working oil pressure adjusting means to adjust the set pressure of the second working oil pressure adjusting means so that the set pressure of

the second working oil pressure adjusting means is higher, by a predetermined pressure, than the pressure of the working oil necessary for driving and rotating the first hydraulic motor, wherein when the first operation unit stops the rotation of the first hydraulic motor, the pressure adjust signal outputting means generates a pressure adjust signal for allowing the second working oil pressure adjusting means to adjust the set pressure of the second working oil pressure adjusting means to be a pressure permitting free flow of the working oil, and wherein the pressure adjust signal outputting means outputs the generated pressure adjust signal to the second working oil pressure adjusting mean;

wherein the first control valve, the first working oil pressure controlling means, and the second working oil pressure controlling means are arranged so that the pressures of the working oil supplied to the first control valve, the first working oil pressure controlling means, and the second working oil pressure controlling means are equal to each other.

10. A hydraulic drive apparatus according to claim 9, further comprising:

supplying oil quantity adjusting means for adjusting a quantity of the working oil supplied from the hydraulic pump;

operation position detecting means for detecting the operation position input to the second operation position

inputting means, generates an operation position detect signal depending on the operation position thus detected, and outputting the operation position detect signal;

supplying oil quantity adjusting signal outputting means for
5 receiving the operation position signal and the operation
position detect signal, generating a supplying oil quantity
adjust signal for allowing the supplying oil quantity adjusting
means to adjust the quantity of working oil that the hydraulic
pump supplies depending on the operation position signal and
10 operation position detect signal, and outputting the supplying
oil quantity adjust signal to the supplying oil quantity adjusting
means,

wherein the supplying oil quantity adjusting signal
outputting means judges whether the second operation unit drives
15 and rotates the second hydraulic motor or stops the rotation of
the second hydraulic motor,

wherein when the second operation unit drives and rotates
the second hydraulic motor, the supplying oil quantity adjusting
signal outputting means generates the supplying oil quantity
20 adjust signal so that the quantity of the working oil that the
hydraulic pump supplies is a predetermined quantity,

wherein when the second operation unit stops the rotation
of the second hydraulic motor, the supplying oil quantity

adjusting signal outputting means computes the quantity of the working oil necessary for driving and rotating the first hydraulic motor depending on the operation position signal, and generates the supplying oil quantity adjust signal so that the quantity of the working oil that the hydraulic pump supplies is larger, by a predetermined quantity, than the quantity of the working oil necessary for driving and rotating the first hydraulic motor.

11. A hydraulic drive apparatus according to claim 10, wherein:

the second control valve controls the quantity of the working oil flowing therethrough depending on the operation position input to the second operation position inputting means in such a manner that the second operation position inputting means supplies an operation oil that is for operating the second control valve, and that depends in quantity on the input operation position, and the second control valve receives the operation oil from the second operation position inputting means to adjust the quantity of the working oil flowing therethrough depending on the quantity of the operation oil; and

the operation position detecting means detects a pressure of the operation oil supplied from the second operation position inputting means to the second control valve to detect the operation position input to the second operation position inputting means.

12. A hydraulic drive apparatus according to claim 9,
further comprising:

at least one or more number of additional hydraulic motors
receiving the working oil from the hydraulic pump to be driven
5 and rotated by the working oil supplied;

at least one or more number of additional operation units,
equal in number to the additional hydraulic motors, for driving
and rotating the additional hydraulic motors;

wherein the additional operation unit includes:

10 additional operation position inputting means to which
operation positions are input; and

additional control valves, through which the working
oil supplied from the hydraulic pump to the respective additional
hydraulic motors flows therethrough, for adjusting a quantity of
15 the working oil flowing therethrough depending on the respective
operation positions input to the additional operation position
inputting means, thereby adjusting the quantity of the working
oil supplied from the hydraulic pump to the respective additional
hydraulic motors;

20 wherein the additional operation unit drives and rotates the
additional hydraulic motors depending on the operation position
input to the additional operation position inputting means;

wherein the second working oil pressure adjusting means

allows the working oil supplied from the hydraulic pump to the additional control valves to flow therethrough, and adjusts a pressure of the working oil flowing therethrough.

5 13. A hydraulic drive apparatus according to claim 12, wherein the additional control valves and the second control valve are arranged so that the pressures of the working oil supplied to the additional control valves and the second control valve are equal to each other.

10 14. A hydraulic drive apparatus according to claim 12, wherein the additional control valves and the second control valve are arranged so that the working oil supplied to the additional control valves is the working oil having flowed through the second control valve.

15 15. A hydraulic drive apparatus according to any of claims 12 to 14, further comprising:

supplying oil quantity adjusting means for adjusting a quantity of the working oil that the hydraulic pump supplies;

20 operation position detecting means which detects an operation position to be input to one of different ones of the second operation position inputting means and the additional operation position inputting means, and generates and outputs an operation position detect signal in accordance with the operation position, the number of the operation position detecting means

hydraulic motor and the additional hydraulic motors, the supplying oil quantity adjusting signal outputting means generates the supplying-oil adjust signal so that a quantity of working oil that the hydraulic pump supplies is equal to a maximum oil quantity of the hydraulic pump,

wherein when all of the second operation unit and the additional operation units stop the rotation of all of the second hydraulic motor and the additional hydraulic motors, the supplying oil quantity adjusting signal outputting means computes a quantity of working oil necessary for driving and rotating the first hydraulic motor depending on the operation position signal, and generates the supplying oil quantity adjust signal so that a quantity of working oil that the hydraulic pump supplies is larger, by a predetermined quantity, than a quantity of working oil necessary for driving and rotating the first hydraulic motor.

16. A hydraulic drive apparatus according to claim 15, wherein the second control valve and the additional control valves control quantities of the working oil flowing therethrough depending on the operation positions input to the second operation position inputting means and the additional operation position inputting means in a manner that the second operation position inputting means and the additional operation position inputting means supply operation oil for operating the second control valve

and the additional control valves depending in quantity on the input operation positions, the second control valve and the additional control valves are supplied with the operation oil from the second operation position inputting means and the additional operation position inputting means, and adjusts the quantities of the working oil flowing therethrough depending on the quantities of the operation oil supplied, and

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a plurality of the operation position detecting means detect pressures of the operation oil supplied to the second control valve and the additional control valves from the second operation position inputting means and the additional operation position inputting means, detect operation positions input to the second operation position inputting means and the additional operation position inputting means by generating and outputting operation oil pressure signals depending on the pressures, and generate and output a plurality of operation position detect signals depending on the operation positions.

17. A hydraulic drive apparatus according to any of claims 9 to 14, wherein the second working oil pressure adjusting means includes an electromagnetic relief valve which adjusts the pressure of the working oil supplied from the hydraulic pump to the first control valve to be equal to or lower than the set pressure by causing the working oil supplied from the hydraulic

pump to flow therethrough, and receives the pressure adjust signal to adjust the set pressure depending on the pressure adjust signal.

claim 9
18. A hydraulic drive apparatus according to ~~any of claims~~
~~9 to 14~~, wherein the second working oil pressure adjusting means

5 includes:

a main relief valve which adjusts the pressure of the working oil supplied from the hydraulic pump to the first control valve by causing the working oil supplied from the hydraulic pump to flow therethrough; and

10 an electromagnetic relief valve which receives the pressure adjust signal to adjust a set pressure thereof depending on the pressure adjust signal, thereby adjusting the set pressure of the main relief valve.

19. A hydraulic drive apparatus comprising:

15 a hydraulic pump for supplying working oil;
a first hydraulic motor which receives working oil from the hydraulic pump and is driven and rotated by the working oil,
a first operation unit for driving and rotating the first hydraulic motor,

20 a second hydraulic motor which receives working oil from the hydraulic pump and is driven and rotated by the working oil supplied, and

a second operation unit for driving and rotating the second

hydraulic motor,

wherein the first operation unit includes first operation position input means which receives a operation position and generates and outputs an operation position signal

5 dependent on the operation position, drive signal outputting

means which receives the operation position signal, and computes

the operation position signal to produce and output a drive signal,

and an electric motor being driven and rotated at a rotational

speed dependent on the drive signal input thereto, and a first

10 control valve which causes the working oil supplied from the

hydraulic pump to the first hydraulic motor, and adjusts a quantity

of the working oil supplied from the hydraulic pump to the

hydraulic motor by adjusting a quantity of the working oil caused

to flow in accordance with the electric motor and the first

15 hydraulic motor, whereby the first operation unit drives and

rotates the first hydraulic motor in accordance with an operation

position input to the first operation position input means,

the second operation unit includes second operation position

inputting means for receiving an operation position, and a second

20 control valve which causes working oil supplied from the hydraulic

pump to the second hydraulic motor to flow, and adjusts a quantity

of the working oil supplied from the hydraulic pump to the second

hydraulic motor by adjusting a quantity of the working oil caused

to flow in accordance with an operation position input to the second operation position inputting means, whereby the second hydraulic motor is driven and rotated in accordance with the operation position input to the second operation position

5 inputting means,

the hydraulic drive apparatus further comprising:

supplying oil detect means which detects a pressure of the working oil supplied from the hydraulic pump to the first control valve, and generates and outputs a supplying-oil pressure signal dependent on the pressure;

drive oil pressure detecting means which detects a pressure of the working oil for driving and rotating the first hydraulic motor, and generates and outputs a drive oil pressure signal dependent on the pressure;

15 working oil pressure adjusting means which receives working oil from the hydraulic pump and causes the working oil supplied to flow, and adjust a pressure of the working oil supplied from the hydraulic pump to the first control valve to be below a set pressure of the working oil;

20 supplying oil quantity adjusting means for adjusting a quantity of the working oil supplied from the hydraulic pump;

working oil quantity adjust means which causes the working oil supplied from the hydraulic pump to the second control valve

to flow, and adjusts a quantity of the working oil caused to flow;

operation position detecting means which detects an operation position input to the second operation position inputting means and generates and outputs an operation position

5 detect signal which depends on the operation position; and

oil quantity adjust signal outputting means which receives

the operation position signal and the operation position detect

signal, and judges from the operation position detect signal as

input whether the second operation unit drives and rotates the

10 second hydraulic motor or stops the rotation of the second

hydraulic motor, when the second operation unit stops the rotation

of the second hydraulic motor, oil quantity adjust signal

outputting means computes a quantity of the working oil necessary

for driving and rotating the first hydraulic motor by use of the

15 operation position signal, generates a working oil quantity

adjust signal for causing the working oil quantity adjust means

to a quantity of the working oil caused to flow by the working

oil quantity adjust means so that the working oil caused to flow

by the working oil quantity adjust means has a quantity of oil

20 relative to a quantity of of the working oil necessary for driving

and rotating the first hydraulic motor, and generates a

working-oil quantity adjust signal for causing the supplying oil

quantity adjusting means to adjust a quantity of the working oil

the second operation position inputting means supplies the operation oil for operating the second control valve, a quantity of the operation oil being dependent on a quantity of the operation position as input, and the second control valve is supplied with

5 the operation oil from the second operation position inputting

means and adjusts a quantity of the working oil caused to flow

in accordance with the operation oil caused to flow, and the

operation position detecting means detects a pressure of the

operation oil supplied from the second operation position

10 inputting means to the second control valve, detects an operation

position input to the second operation position inputting means

by generating and outputting an operation oil pressure signal

dependent on the pressure, and generates and outputs an operation

position detect signal dependent on the operation position.

15 21. A hydraulic drive apparatus according to claim 19 or

20, further comprising pressure adjust signal outputting means

which receives the supplying-oil pressure signal, the drive oil

pressure signal, and the operation position detect signal,

judges from the operation position detect signal as input whether

20 the second operation unit drives and rotates the second hydraulic

motor or stops the rotation the second hydraulic motor, when the

second operation unit stops the rotation of the second hydraulic

motor, the pressure adjust signal outputting means computes a

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pressure of the working oil for driving and rotating the first hydraulic motor by use of the supplying-oil pressure signal and the drive oil pressure signal, and generates a pressure adjust signal for causing the working oil pressure adjusting means to
5 adjust a set pressure of the working oil pressure adjusting means so that the set pressure of the working oil pressure adjusting means is higher than a pressure of the working oil necessary for driving and rotating the first hydraulic motor by a predetermined value of pressure, when the second operation unit drives and
10 rotates the second hydraulic motor, the pressure adjust signal outputting means generates a pressure adjust signal for causing the working oil pressure adjusting means to adjust a set pressure of the working oil pressure adjusting means so that a set pressure of the working oil pressure adjusting means reaches a
15 predetermined pressure in value, and outputs the pressure adjust signal generated to the working oil pressure adjusting means.

22. A hydraulic drive apparatus comprising:
- hydraulic pump for supplying working oil,
 - a first hydraulic motor being driven and rotated by the
20 working oil received from the hydraulic pump when operated,
 - a first operation unit for driving and rotating the first hydraulic motor,
 - a second hydraulic motor being driven and rotated by the

working oil received from the hydraulic pump,

a second operation unit for driving and rotating the second hydraulic motor,

at least one or more number of additional hydraulic motors being driven and rotated by the working oil received from the hydraulic pump, and

additional operation units for driving and rotating the additional hydraulic motor, the number of the additional

operation units being equal to that of the additional hydraulic motors,

wherein the first operation unit includes

first operation position input means for generating an operation position signal in accordance with an operation position input thereto,

drive signal outputting means for computing the operation position signal input thereto into a drive signal and outputting the same,

an electric motor being driven and rotated at a rotational speed dependent on the drive signal input thereto, and

a first control valve for adjusting a quantity of the working oil supplied from the hydraulic pump to the first hydraulic motor by causing the working oil supplied from the hydraulic pump to the first hydraulic motor to flow and adjusting a quantity of the

working oil caused to flow in accordance with the rotational speeds of the electric motor and the first hydraulic motor,

whereby the first hydraulic motor is driven and rotated in accordance with an operation position input to the first operation position input mean,

the second operation unit includes second operation position inputting means to which an operation position is input, and

a second control valve for adjusting a quantity of the working oil supplied from the hydraulic pump to the second hydraulic motor

by causing the working oil supplied from the hydraulic pump to the second hydraulic motor and adjusting a quantity of the working

oil caused to flow in accordance with an operation position input to the second operation position inputting means; whereby the

second hydraulic motor is driven and rotated in accordance with the second operation position inputting means;

the additional operation units each includes additional operation position inputting means to which an operation position

is input, and an additional control valve for adjusting a quantity of the working oil supplied from the hydraulic pump to the

additional hydraulic motor by causing the working oil supplied from the hydraulic pump to the additional hydraulic motor to flow,

and adjusting a quantity of the working oil caused to flow in accordance with an operation position input to the additional

operation position inputting means, and whereby the additional hydraulic motor is driven and rotated by an operation position input to the additional operation position inputting means, the hydraulic drive apparatus further comprising:

5 supplying oil detect means which detects a pressure of the working oil supplied from the hydraulic pump to the first control valve, and generates and outputs a supplying-oil pressure signal dependent on the pressure;

drive oil pressure detecting means which detects a pressure of the working oil for driving and rotating the first hydraulic motor, and generates and outputs a drive oil pressure signal dependent on the pressure;

working oil pressure adjusting means for adjusting a pressure of the working oil supplied from the hydraulic pump to the first control valve by causing the working oil supplied from the hydraulic pump to flow;

supplying oil quantity adjusting means for adjusting a quantity of the working oil that the hydraulic pump supplies;

working oil quantity adjust means which causes the working oil supplied from the hydraulic pump to the second control valve and the working oil supplied from the hydraulic pump to the additional control valve to flow, and adjusts a quantity of the working oil caused to flow;

a plurality of operation position detecting means which detects operation positions input to the second operation position inputting means and the additional operation position inputting means, and generates and outputs an operation position

5. detect signal in accordance with the operation positions; and

oil quantity adjust signal outputting means which receives the operation position signal and the operation position detect signal, and judges from the operation position detect signal as

input whether the second operation unit and at least one of the additional operation units drive and rotate any of the second

10. hydraulic motor and the additional hydraulic motors or the second operation unit and the additional operation units stop the

rotation of the second hydraulic motor and the additional hydraulic motors, when the second operation unit and all of the

hydraulic motors, when the second operation unit and all of the

15. additional operation units stop the second hydraulic motor and the additional hydraulic motors, the oil quantity adjust signal

outputting means computes a quantity of working oil necessary for driving and rotating the first hydraulic motor by use of the

operation position signal, and generates a working oil quantity

20. adjust signal for causing the working oil quantity adjust means to adjust a quantity of the working oil caused to flow by the

working oil quantity adjust means in order that the working oil

caused to flow by the working oil quantity adjust means has a

predetermined quantity relative to the quantity of the working oil necessary for driving and rotating the first hydraulic motor, generates a supplying-oil adjust signal for causing the supplying oil quantity adjusting means to adjust a quantity of the working oil that a quantity of the hydraulic pump supplies so that the working oil that the hydraulic pump supplies is larger than the quantity of the working oil necessary for driving and rotating the first hydraulic motor by a predetermined quantity, when the second operation unit and at least one of the additional operation units drive and rotate any of the second hydraulic motor and the additional hydraulic motors, the oil quantity adjust signal outputting means generates the working oil quantity adjust signal so that the working oil quantity adjust means causes the working oil to flow freely, generates the supplying-oil adjust signal so that a quantity of the working oil that the hydraulic pump supplies reaches a predetermined quantity, and oil quantity adjust signal outputting means for outputting the working oil quantity adjust signal generated to the working oil quantity adjust means and the supplying-oil adjust signal generated to the supplying oil quantity adjusting means;

wherein the first control valve, the working oil pressure adjusting means, and the working oil quantity adjust means are arranged so that the quantities of the working oil fed to the first

control valve, the working oil pressure adjusting means, and the working oil quantity adjust means are equal to one another.

23. A hydraulic drive apparatus according to claim 22, wherein the additional control valve and the second control valve

5 are arranged so that the quantities of the working oil fed to the

additional control valve and the second control valve are equal to one another.

24. A hydraulic drive apparatus according to claim 22;

wherein the additional control valve and the second control valve

10 are arranged such that the working oil supplied to the additional

control valve is the working oil having flowed through the second

control valve.

a 25. A hydraulic drive apparatus according to ~~any of claims~~

a ~~22 to 24~~, wherein the second control valve and the additional

15 control valve adjust a quantity of the working oil caused to

flow in accordance with an operation position input to the second

operation position inputting means and the additional operation

position inputting means in a manner that the second operation

position inputting means and the additional operation position

20 inputting means supply operation oil for operating the second

control valve and the additional control valve, a quantity of

the operation oil being dependent on an operation oil as input,

receive the operation oil from the second operation position

claim 22

inputting means and the additional operation position inputting means, and adjust a quantity of the working oil caused to flow in accordance with a quantity of the operation oil supplied, and the operation position detecting means detects a pressure of an operation oil supplied from the second operation position.

inputting means and the additional operation position inputting means to the second control valve and the additional control valve, and detects an operation position input to the second operation position inputting means and the additional operation position inputting means by generating and outputting an operation oil pressure signal that is dependent on the pressure.

26. A hydraulic drive apparatus according to ~~any of claims~~ *claim 22*

a ~~22 to 24~~, further comprising:

pressure adjust signal outputting means receives the supplying-oil pressure signal, the drive oil pressure signal, and the operation position detect signal, and judges from the operation position detect signals as input whether the second operation unit and at least one of the additional operation units drive and rotate any of the second hydraulic motor and the additional hydraulic motors or the second operation unit and all of the additional operation units stop the rotation of the second hydraulic motor and the additional hydraulic motors, when the second operation unit and all of the additional operation units

the first control valve to be below a set pressure by causing the working oil supplied from the hydraulic pump to flow, and adjusts the set pressure in accordance with the pressure adjust signal input thereto.

5 28. A hydraulic drive apparatus according to claim 21, wherein the working oil pressure adjusting means includes a main relief valve for adjusting a pressure of the working oil supplied from the hydraulic pump to the first control valve to be below the set pressure by causing the working oil supplied from the hydraulic pump to flow, and an electromagnetic relief valve for adjusting a set pressure of the main relief valve by adjusting the set pressure in accordance with the pressure adjust signal input thereto.

10 29. A fluid circuit for a hydraulic drive apparatus, comprising:
15 a tank;
a hydraulic pump in fluid communication with the tank;
an electro-hydraulic servovalve in fluid communication with and located between the tank and the hydraulic pump, the
20 electro-hydraulic servovalve being mechanically coupled to an electric motor;

a hydraulic motor in fluid communication with the electro-hydraulic servovalve, the hydraulic motor being

mechanically coupled to the electro-hydraulic servovalve;

a pair of first and second pressure detectors respectively detecting hydraulic pressures in first and second fluid passages extending from the electro-hydraulic servovalve to the hydraulic

5 motor and from the hydraulic motor to the electro-hydraulic

servovalve;

a control valve in fluid communication with the tank and a

third fluid passage extending from the hydraulic motor to the

electro-hydraulic servovalve; and

10 a third pressure detector detecting hydraulic pressure in

the third fluid passage.

30. A fluid circuit according to claim 29, wherein the

control valve is controlled so that the hydraulic pressure

detected by the third pressure detector is higher, by at least a

15 predetermined pressure difference, than a higher one of the

hydraulic pressures detected by the first and second pressure

detectors.

31. A fluid circuit according to claim 29, wherein the

control valve includes a main relief valve and an electromagnetic

20 relief valve.

32. A fluid circuit according to claim 29, further

comprising:

a second electro-hydraulic servovalve in fluid

communication with and located between the tank and the hydraulic pump in parallel relation to the first electro-hydraulic servovalve, the second electro-hydraulic servovalve being mechanically coupled to a second electric motor;

5 a second hydraulic motor in fluid communication with the second electro-hydraulic servovalve, the second hydraulic motor being mechanically coupled to the second electro-hydraulic servovalve;

10 a pair of third and fourth pressure detectors respectively detecting hydraulic pressures in fluid passages extending from the second electro-hydraulic servovalve to the second hydraulic motor and from the second hydraulic motor to the second electro-hydraulic servovalve.

15 33. A fluid circuit according to claim 32, wherein the control valve is controlled so that the hydraulic pressure detected by the third pressure detector is higher, by a predetermined pressure difference, than the highest one of the hydraulic pressures detected by the first, second, third and fourth pressure detectors.

20 34. A fluid circuit according to claim 29, further comprising:

at least one general purpose valve in fluid communication with and located between the control valve and the tank; and

at least one hydraulic motor respectively in fluid communication with the at least one general purpose valve.

35. A fluid circuit according to claim 34, wherein the control valve is controlled so that the hydraulic pressure

5 detected by the third pressure detector is higher, by a

predetermined pressure difference, than a higher one of the

hydraulic pressures detected by the first and second pressure detectors.

36. A fluid circuit according to claim 34, wherein the

10 control valve is controlled so that a set pressure of the control

valve is a predetermined value.

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